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PRODUCING HIGH QUALITY PIGLETS

5. Sustainable meat production and improvement of animal welfare

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In the swine industry, the status of the pig's gut health not only affects the well-being and performance of the animal, but has consequences for all of us in terms of resource-efficient living. By using wood-based feed supplements made from renewable sources, swine farmers may provide a major contribution to sustainable meat production and improvement of animal welfare.

KEY FOR SUSTAINABILITY AND EFFICIENCY

Sustainable pig production implies a prudent use of resources. To nourish the world's population in the future, it will be of the utmost relevance to care for the planet and preserve the environment by aiming for: less greenhouse gas emissions, less nutrient waste, enhance (or at least stabilise) biodiversity and avoid deforestation.

Consequently, the aim is to use as few feedstuffs as possible to produce meat and thus improve the efficiency of converting feed mass into pig body mass. Moreover, enhanced feed efficiency is crucial for profitability since feed costs represent roughly two-thirds of the total operation cost of a conventional swine farm.

Today we face a time shaped by a geopolitical crisis, which demonstrates the fragility of the food and feed supply: although high producing animals need high quality feed, effort is needed to minimise feed-to-food competition, which means that plant material, which could be used by humans should not be considered primarily for use as a feedstuff.

In turn, this means that we need to pay even more attention to the health and functionality of the gastrointestinal tract to improve feed efficiency, especially when using sub-optimal quality feed. Improving feed efficiency means improving the metabolic utilisation of dietary nutrients, and an improved nutrient absorption, for which an intact and healthy gut is a prerequisite.

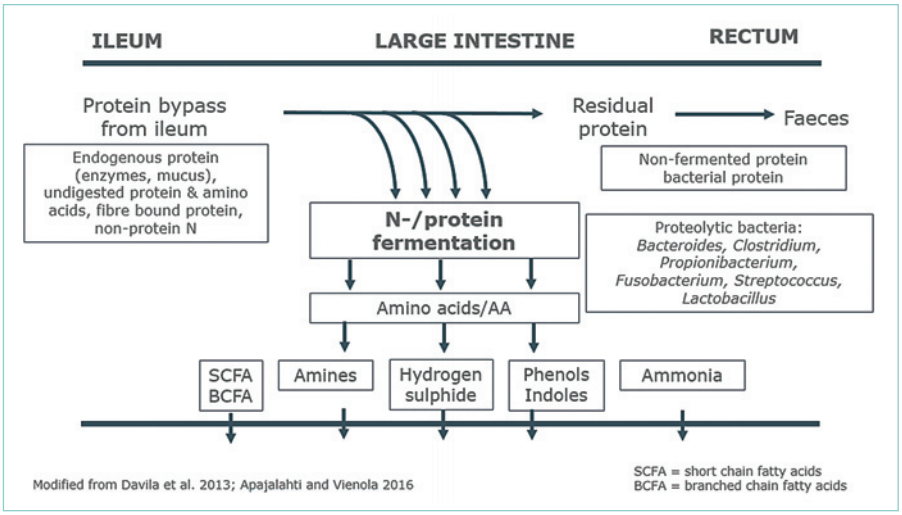

Fig. 1. Overview of the proteolytic fermentation process in the pig's intestinal tract.

REDUCING MEDICAL COSTS

Since the epithelial cells of the gastrointestinal tract are the first contact sites for pathogens, the gastrointestinal tract must not be seen in the context of nutrient absorption only, but needs to be considered as an important part of the animals' immune defence.

Thus, an intact and healthy gut tissue lowers the risk of an invasion of pathogens from the lumen to the bloodstream and hence, indirectly counteracts the outbreak of local and/or systemic infections, whilst maintaining a high resorptive capacity for nutritive molecules.

Every infectious disease avoided, is saving money, since costs for medication, treatment and performance losses are avoided. Also important for a healthy and well-functioning gut is its role as the host of a complex micro-ecosystem of a variety of micro-organisms, referred to as microbiota.

Since a balanced microbiota is important for the development of gut morphology, immune functions as well as digestive physiology, the diversity of those micro-organisms may directly influence growth performance, feed digestion or, when imbalanced, can cause malfunctions leading to, for example, diarrhoea or constipation.

The presence of specific micro-organisms is needed to make energy usable, which would be unused without their help: in particular fibre-rich feedstuffs contain a high share of molecules indigestible via the endogenous enzymes produced by pigs. Those molecules may be degraded by micro-organisms and energy will be released in the form of fermentation metabolites, which, in turn, can be absorbed by the colonocytes of the intestinal tract.

MANAGING FERMENTATION

Regarding gut health, the modulation and management of the microbiota is one of the most important ways to avoid intestinal malfunction, since not only indigestible fibre fractions may be fermented microbiologically, but also digestible substrate if not absorbed will be utilised by microbiota. Protein, amino acids or fibre-bound protein, that is not utilised because of an oversupply or because of a disease dependent impairment of the intestinal resorptive capacity, will reach the large intestine and be fermented by proteolytic bacteria.

Fermentation of protein may lead to the formation of toxic and pro-inflammatory

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metabolites, such as biogenic amines, ammonia, or indoles (Fig. 1). Moreover, the higher the share of substrate for proteolytic bacteria, the faster they proliferate and the microbial balance drifts towards a dysfunctional one causing an extraordinarily enhanced protein fermentation.

A balanced microbiota 'prefers' carbohydrates as a source of carbon since the utilisation of carbohydrates as an energy source is more efficient than the utilisation of proteins or amino acids.

Thus, in a healthy situation, a higher share of carbohydrates than protein reaches the hindgut, which favours the saccharolytic fermentation, resulting in the formation of short chain fatty acids as fermentation metabolites, beneficially influencing the intestinal tract.

This means, to manage the microbiome towards a healthy gut function, swine feed needs to be rich in insoluble fibre but fermentable fibre.

WOOD-DERIVED PRODUCTS FOR A HEALTHY GUT

In order to promote gut health throughout the post-AGP era, safe alternatives were developed within the last decade. Products from renewable sources, without affecting the feed-to-food competition, such as wood, gain high interest among swine farmers for reasons of sustainability, profitability, and animal welfare.

With agromed Protect, the Austrian company agromed succeeded in the development of a wood-derived feed additive by using selected tree species and different parts of trees rich in bio-active molecules, i.e. lignans and phenolic acids, strengthening the gut barrier and thus providing a lower risk for pathogens to invade the blood system.

Moreover, the sophisticated combination of lignans and phenolic acids support gut health by a remarkable antioxidative mode of action proven in vitro gut cell culture models as well as in vivo trials on piglets, as presented at the Zero Zinc Summit held in June 2022 in Copenhagen, Denmark.

Another, rather well-known wood-derived product is lignocellulose acting as a fibre concentrate. For efficient management of fermentation processes, the quality of the lignocellulose product is essential. Eubiotic lignocellulose (LC) is an insoluble, but nevertheless partly fermentable lignocellulose, so it beneficially influences the composition of microbiota in a way to reduce unfavourable proteolytic fermentation.

Table 1 demonstrates a reduced formation of biogenic amines analysed in digesta samples from two parts of the intestinal tract of weaning piglets, after feeding for eight weeks on a control diet supplemented with either soybean hulls or LC (OptiCell, agromed Austria GmbH) as an additional fibre source.

	Control	Soybean hulls	OptiCell
Inclusion level (%)	-	2.5	1.5
Ileum			
Cadaverine (mg/kg DM)	330[a]	377[a]	48[b]
Σ amines Ileum (mg/kg DM)	1.916	1.869	1.644
Colon			
Cadaverine (mg/kg DM)	488	581	305
Σ amines Ileum (mg/kg DM)	2.199	2.380	2.019

Table 1. Reduced formation of biogenic amines analysed in digesta samples.

CONCLUSION

Wood-based feed solutions offer new but well explained opportunities to support gut health management and act as a sustainable answer in terms of animal nutrition and animal welfare. ■